

# (12) UK Patent Application (19) GB (11) 2 334 172 (13) A

(43) Date of A Publication 11.08.1999

(21) Application No 9901598.4

(22) Date of Filing 25.01.1999

(30) Priority Data

(31) 19804050

(32) 03.02.1998

(33) DE

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(51) INT CL<sup>6</sup>

G01S 7/481 // G01S 17/10

(52) UK CL (Edition Q )

H4D DLRC D72X D751 D782 D783

(56) Documents Cited

GB 2233182 A GB 1507208 A WO 98/08052 A1

(58) Field of Search

UK CL (Edition Q ) H4D DLRC DLRE DLSX  
INT CL<sup>6</sup> G01S 7/481 17/08 17/10 17/32 17/36

(54) Abstract Title

**Optical distance measurement**

(57) A device for optical distance measurement by travel time measurement is proposed which is equipped with a transmitting device (11) for emitting a focused optical measurement signal, with receiving optics (18) for capturing measurement signal components reflected at a distant object (27) and with an optoelectronic transducer (20) disposed downstream of the receiving optics (18). The transmitting device (11) comprises a tubular exit conduit (15) which forms, at its outside wall (15a), a receptacle (40) for the transducer (20) and which carries a deflection device (44) for the measurement signal at a fixed distance from the transducer receptacle (40) between receptacle (40) and an object-side exit opening (16).

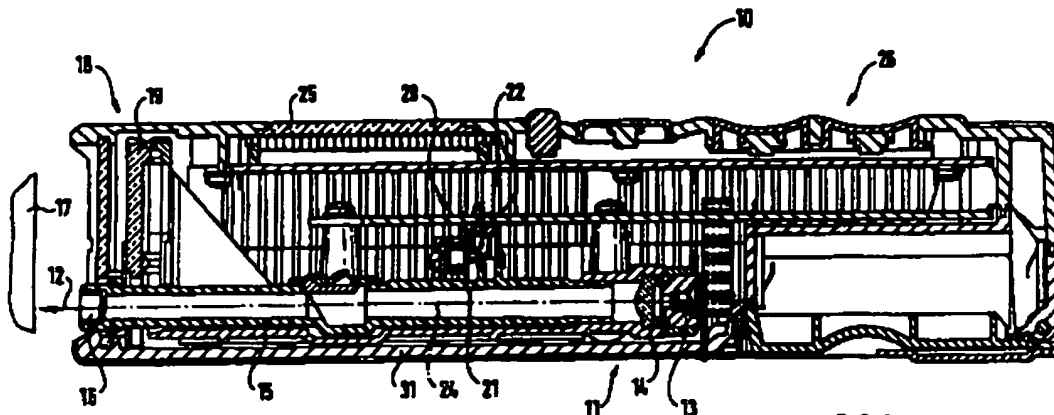


FIG. 1

GB 2 334 172 A

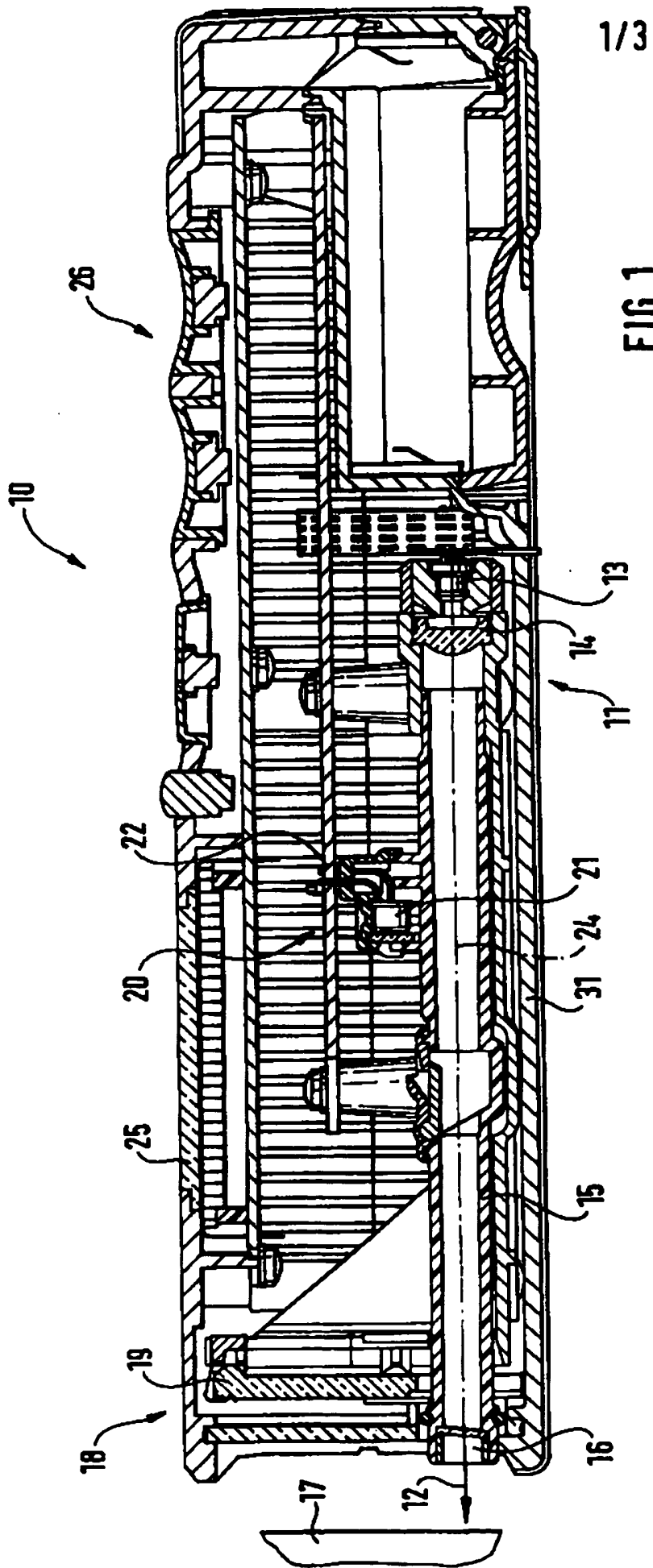


FIG. 1

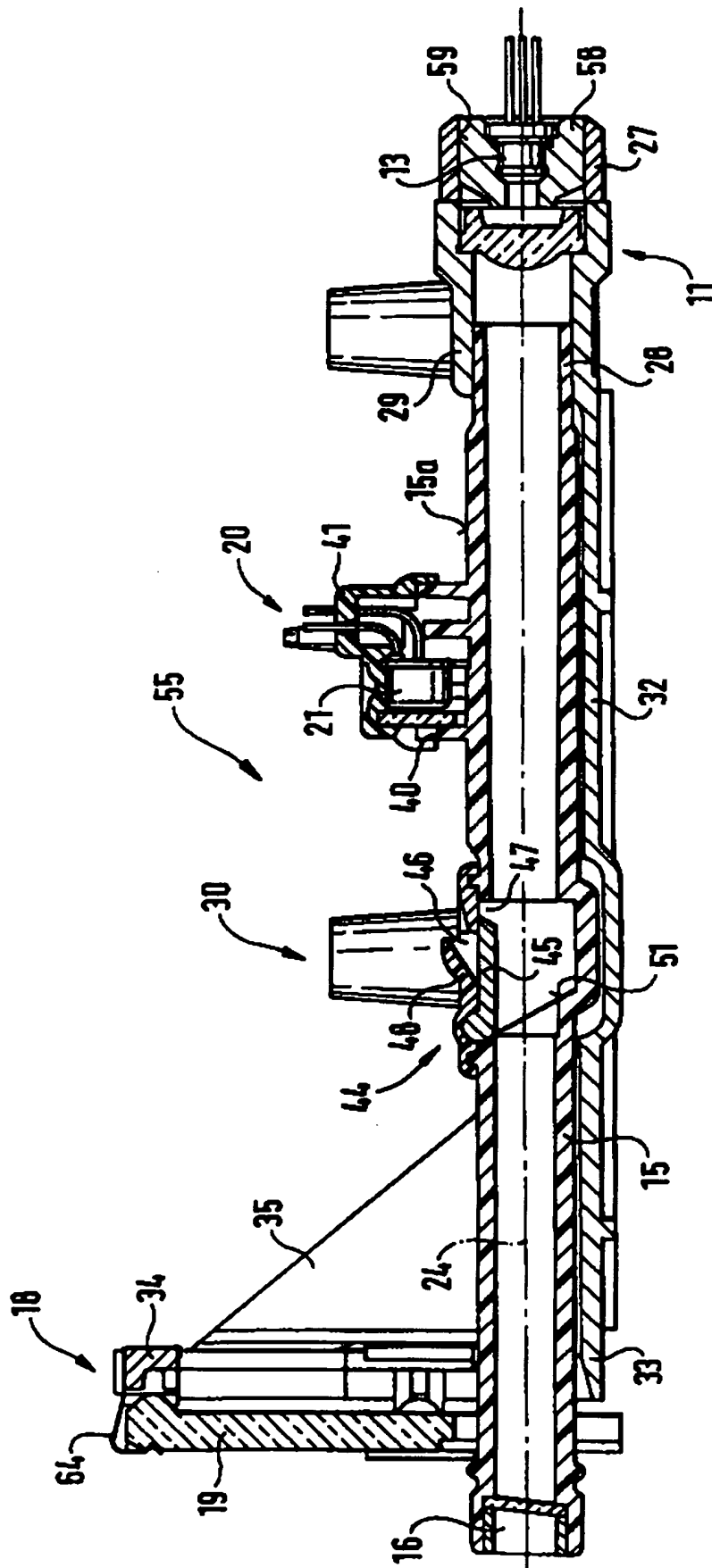


FIG. 2

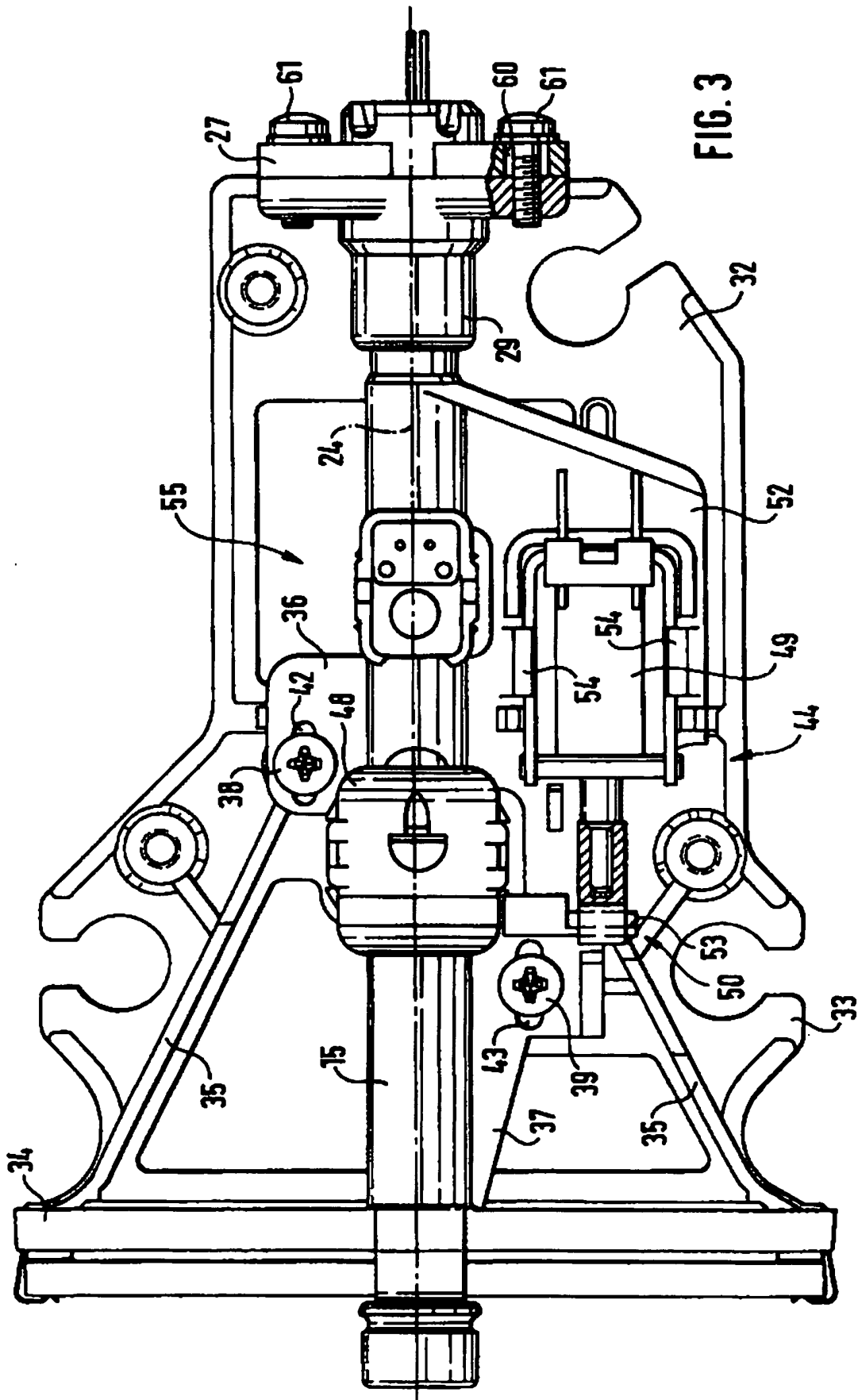


FIG. 3

**Device for optical distance measurement**

The invention proceeds from a device according to the preamble of Claim 1. A device for optical distance measurement has already been disclosed (DE-A-43 16 348) which comprises, as individual components, a transmitting device for emitting a focused measurement signal, receiving optics for capturing a measurement signal component reflected at a distant object, an optoelectronic converter connected downstream of the receiving optics and a deflection device for generating a reference signal. In the manufacture of the distance-measuring instrument, the individual modules are mounted singly. As a consequence of unavoidable production tolerances, the modules have subsequently to be tuned, for the purpose of an optimum functioning of the distance-measuring device, to one another and individually aligned with one another.

The device according to the invention for optical distance measurement has the advantage that the components can be permanently fixed in position and aligned in a simple manner, which makes possible an inexpensive and efficient assembly. The number of axes to be aligned is reduced.

As a result of the measures cited in the dependent claims, advantageous developments and improvements of the device according to the invention for distance measurement are possible.

An exemplary embodiment of the invention is shown in the drawing and explained in greater detail in the description below. Figure 1 shows a longitudinal section through a device for distance measurement, Figure 2 shows a section through a transmitting section and a receiving section of the device and Figure 3 shows a plan view of the transmitting section and receiving section according to Figure 2.

In Figure 1, a device for distance measurement, referred to as distance-measuring instrument, is denoted by 10. The distance-measuring

instrument 10 comprises a transmitting device 11 for emitting a measurement signal in the form of a focused optical light signal. The transmitting device 11 comprises a laser diode 13 and a collimating lens 14, with whose aid the measurement signal is guided in focused form through an exit conduit 15 in the direction of an arrow 12 along a longitudinal axis 24. The measurement signal 12 leaves the exit conduit 15 through an exit opening 16 and then impinges on an object 17, whose distance from the distance-measurement instrument 10 is to be determined.

The distance-measuring instrument 10 has receiving optics 18 comprising a lens 19 which captures measurement signal components reflected at the object 17 and guides them to an optoelectronic transducer 20 disposed behind the receiving optics 18. The transducer 20, which is preferably designed as avalanche photodiode 21 receives the measurement signal components and feeds them to an evaluating device 22 in electrical form.

In the evaluation device 22, the distance of the object 17 is determined from the travel time differences between transmitted measurement signal 12 and reflected measurement signal components. The distance determined is emitted in an indicating device 25. The operator can enter commands via a keyboard 26.

As emerges from Figure 2, the transmitting device 11, receiving optics 18 and transducer 20 form a common structural unit 30 which is integrated as a preassembled structural group into a housing 31 (Figure 1) of the distance-measuring instrument 24. The structural unit 30 comprises a carrier body 32, which is preferably made of zinc diecasting metal. The carrier body 32 is predominantly designed in plate form. A frame 34 is formed on a side 33 of the carrier body 32, which side faces the object, and is supported by means of two lateral ribs 35 on the carrier body 32.

The exit conduit 15 is firmly mounted on the carrier body 32. For this purpose, straps 36, 37 are moulded on the exit conduit 15, by means of which straps the exit conduit 15 is screwed by means of screws 38, 39 to the carrier body 32. The screws 38, 39 engage through elongated holes 42, 43 which are disposed in the straps 36, 37 parallel to the longitudinal axis 24 of the measurement signal.

The exit conduit 15, which is preferably made of plastic, for example by injection moulding, forms, at its outside wall 15a, a receptacle 40 for the transducer 20. The photodiode 21 is inserted into the receptacle 40 and is secured by means of a cover 41, which can preferably be snapped onto the receptacle 40 by latching means.

Between the transducer receptacle 40 and the exit opening 16, the conduit carries a deflection device 44 for the measurement signal for the purpose of carrying out a reference measurement, such as is disclosed, for example, in DE-A-43 16 348. The deflection device 44 has a flap 45 which is disposed pivotably in the exit conduit 15. In Figure 2, the flap 45 is shown in an upper setting position in which it closes an opening 46. The opening 46 is part of a perforation 47 in the outside wall 15a of the exit conduit 15, which is covered by a cap 48 which is likewise clipped on. The flap 45 can be swivelled into a second setting position against a stop 51 by means of an actuator 49 via an adjustment mimicking device 50 having an eccentric arm 53, in which position the measurement signal is reflected via the opening 46 to the transducer 20. In this position, no measurement signals then reach the exit opening 16.

The actuator 49 is clamped to a holding plate 52 which is laterally formed onto the exit conduit 15. The exit conduit 15 consequently forms, together with the deflection device 44 and the transducer 20, a preassembled subassembly 55.

The laser diode 13 is accommodated in a sleeve 58 which has a rotationally symmetrical outside circumference. The sleeve 58 is accommodated

in a longitudinally displaceable manner in a bore 59 in a carrier piece 27. The carrier piece 27 is flanged on at the end face to a coupling-shaped holder 29 which accommodates the collimating lens 14 and one end 28 of the exit conduit 15. The holder 29 is part of a carrier body 32. The flange joint between carrier piece 27 and holder 29 is disposed in a plane situated perpendicularly with respect to the longitudinal axis 24. The perforation bores 60 in the carrier piece 27 have alignment play with respect to the shanks of the flange screws 61 so that an alignment of the laser diode 13 with respect to the longitudinal axis in line with the flange plane is ensured. As a result of axial displacement and subsequent axial locking, the laser diode 13 is aligned with the collimating lens 14 in such a way that it reaches its focal plane. The lens 19 of the receiving optics 18 is fixed in position on the frame 34 by means of spring clips 64.

The preassembled subassembly 55 is then mounted on the preassembled carrier body 32. Since all the components are already fixed in position, this assembly step is very simple. By means of an axial alignment of the subassembly 55 with respect to the carrier body 32, the distance of the lens from the photodiode 21 is then only adjusted so that the photodiode 21 ends up approximately in the focus of the lens 19.



**CLAIMS**

1.           **Device for optical distance measurement by travel time measurement, having a transmitting device (11) for emitting a focused optical measurement signal, having receiving optics (18) for capturing measurement signal components reflected at a distant object (17), and having an optoelectronic transducer (20) downstream of the receiving optics (18), characterized in that the transmitting device (11) comprises a tubular exit conduit (15) which forms, at its outside wall (15a), a receptacle (40) for the transducer (20) and which carries a deflection device (44) for the measurement device between receptacle (40) and an object-side exit opening (16).**
2.           **Device according to Claim 1, characterized in that the deflection device (44) is disposed at a fixed distance from the transducer receptacle (40).**
3.           **Device according to Claim 1 or 2, characterized in that the exit conduit (15) forms, together with the deflection device (44) and the transducer (20), a subassembly (55) which can be preassembled.**
4.           **Device according to Claim 2, characterized in that the exit conduit (15) is manufactured in one piece from plastic, preferably by injection moulding.**
5.           **Device according to one of the preceding claims, characterized in that straps (36, 37) are formed onto the exit conduit (15) for mounting on a carrier body (32).**
6.           **Device according to Claim 5, characterized in that the straps (36, 37) form axial elongated holes (42, 43), i.e. elongated holes situated parallel to a**

longitudinal axis (24) of the exit conduit (15), for fixing and alignment of the subassembly (55) on the carrier body (32).

7. Device according to Claim 5 or 6, characterized in that an entry-side end (28) of the exit conduit (15) projects into a coupling-shaped holder (29) which is formed by the carrier body (32).

8. Device according to Claim 7, characterized in that the holder (29) accommodates a collimating lens (14) which is disposed axially in front of the exit conduit (15).

9. Device according to Claim 7 or 8, characterized in that a carrier piece (27) which accommodates a laser diode (13) is mounted on the end face of the holder (29).

10. Device according to Claim 9, characterized in that the carrier piece (27) is joined to the holder (29) by means of a flange joint which makes possible an alignment of the laser diode (13) in a plane approximately perpendicular to the longitudinal axis (24).

11. Device according to one of the preceding claims, characterized in that the deflection device (44) has a flap (45) which is mounted pivotably with respect to the exit conduit (15) and which is adjustable by means of an actuator (49), and in that a holding plate (52) is formed in one piece onto the exit conduit (15) for the purpose of clamping the actuator (49).

12. A device for optical distance measurement substantially as herein described with reference to the accompanying drawings.



**Application No:** GB 9901598.4  
**Claims searched:** All

**Examiner:** C R Brain  
**Date of search:** 21 May 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H4D (DLRC, DLRE, DLSX)

Int Cl (Ed.6): G01S 7/481, 17/08, 17/10, 17/32, 17/36

Other:

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | Relevant to claims |
|----------|---|--------------------|
| A        | GB 2233182 A (Phillips)                   |                    |
| A        | GB 1507208 (American Optical)             |                    |
| A        | WO 98/08052 A1 (Laser Technology)         |                    |

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
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